

REVIEW ON SMART HEALTHCARE SYSTEMS USING CLOUD AND BIG DATA ANALYSIS

PRACHI. D. JUNWALE & SUCHITA. S. DANGE

*Assistant Professor, Department of Computer Engineering, Ramrao Adik Institute and
Technology, Nerul, Navi Mumbai, Maharashtra, India*

ABSTRACT

Many researchers are working for decades, to enhance the quality and speed of analysis in health care systems. For improving treatment quality, Cyber-physical systems are used in biomedical field. Cyber-physical systems along with cloud computing techniques and big data analysis technology are used to improve quality and to efficiently handle the huge heterogeneous medical data. In this paper, health care information is collected from multisource, heterogeneous sources like hospitals, Internet, or user-generated content. These data is then cleaned and pre-processed and further given to management layer, which uses distributed file storage component and distributed parallel computing component, which enhances the speed and quality of heterogeneous data. Cloud computing technology improves economies of scale by resource sharing. Application service interface is used to manage and develop a uniform application program interface for users. The result of this study enhances quality of health care applications using cloud and big data analysis techniques.

KEYWORDS: *Big Data Analysis, Cloud Computing Technology, Cyber-Physical Systems (CPS) [3]*

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INTRODUCTION

For many years, medical researchers are trying to enhance treatment methods for patients, so that speed of treatment should increase and to minimize pain of treatment process. Digital computer based technologies are used to improve quality of treatment in biomedical field. Cyber-physical systems (CPS) are specially used in many fields now a day [2]. As biomedical information is continuously increasing, so it is very difficult to store and manage for differently structured medical information. Most of clinical devices generate huge amount of information every day. This data is very useful for doctor and researcher to study and analyse about the diseases. It's easy to manage health care information using big data analysis and cloud computing technologies [1]. These technologies provide secure environment, as cryptography techniques of computer network are applied, so that authorised user can only access this information for their analysis and research [6].

Cloud computing and big data are emerging techniques used to store all biomedical information. Cloud is consisting of various hardware, software, high performance networks, storage and applications [5]. The participant that uses cloud is generally end user, who does not know about underlying technologies. They are using all services that cloud service provides, and business management will provide on cloud. Business management team will provide all facilities and resources that are required by any companies or end user, also it will do all management on cloud. It sometimes, provide common platform which two or more user and companies can use in sharing. Thus, this technique will save time, money and space. It is changing the way people in business access,

deliver and understand the information. The main features are that, facilities are available all time; anyone can use these facilities any time depending on demands and requirement [7]. These facilities can be scaled as user requirement changes, and if new user added on cloud. Any user will get cloud computing facilities very easily than lengthy procedure. They have to request which facilities they want, how much resources they are going to use, as well as, how much time they are going to use those facilities. This information user has to provide to service provider. When any company is going to start new application, it has to send request to facilities provider, to get extra facilities and resources from them. They will check the availability of existing facilities and new demanded facilities, depending on the requirement they configure cloud environment for company [14]. For each and every facility that they are providing to user, service provider will charge money. Facilities provider has to provide common application programming interfaces to all users, so that user more easily links cloud facilities.

Cyber-physical systems are innovated to combine actual physical hardware and components with computational component and software in biomedical field. It is a device, which is operated by computer programs and techniques, and it uses high performance internet service to collaborate with user requirement [3]. Figure 1 shows Cyber-physical systems, which are combination of various control mechanism such as real time programs and applications, network control systems, intelligent systems etc.

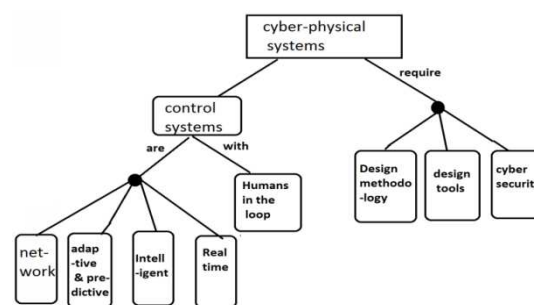


Figure 1: Cyber-Physical Control System

This control mechanism is continuously interacting with internet and human, to enhance user requirement and analyse its quality [12]. Although in healthcare field there are many innovations, but there are some problems that need to be solved, especially in data analysis and data access using open platform and heterogeneous data management [4]. Thus, the biggest challenge for a comprehensive healthcare system is to handle and manage heterogeneous information and data taken from various sources [1]. So, in this paper, cloud computing and big data techniques are used to handle this issue [3]. These can be summarized as follows:

- Integrate public medical resources and personal health devices to get unified data collection layer [3].
- Analysis and storage management of multisource heterogeneous healthcare data using cloud-enabled platform.
- Developer and users uses unified application programming interface (API), which can be designed by application service cloud [2].

ARCHITECTURE

Design Problems

For biomedical industry, big data analysis and cloud computing are rapid growing technology used in innovations. Now a day, medical knowledge is rapid growing, so data collection and analysis is big problem [11]. Figure 2 shows

healthcare ecosystem, in which data are coming from hospital, public health, research institute, drug-maker, patient, network operator etc. Thus, cloud computing and big data technology is essential components in biomedical field [2]. It manages heterogeneous data coming from various sources. It gives unified programming interface, which improves programming interface to users. It provides application service platform, which is used for data sharing and resource optimization.

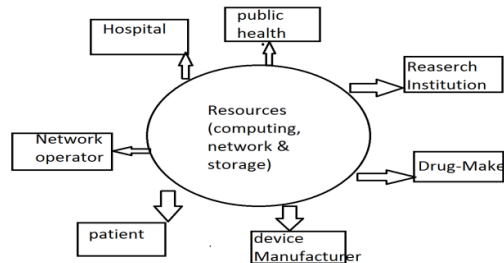


Figure 2: Healthcare Ecosystem

Architecture using Big Data and Cloud Computing

Figure 3 shows the architecture of CPS using Big data and Cloud computing.

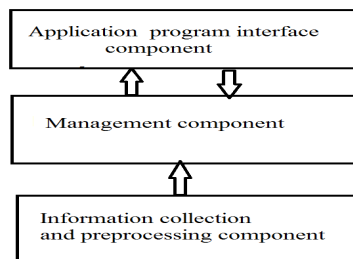


Figure 3: Architecture

It has three components, namely, information collection component, management component and application program interface component [2].

- Information collection component: Information is collected from various healthcare centres like clinical data, research data, patient data, user expenses data etc. This information is given to integrated data collection interfaces, which further pre-processed and improves quality and consistency of information and reduces redundancy.
- Management component: Management component has information storage on cloud and parallel computing unit. In this, big data analysis is used to handle large, heterogeneous information [2].
- Application program interface component: Application program interface component will provide common platform to all user and developer.

STAGES OF MODELS

Information Collection Component

Data is collected from various healthcare data like research data, clinical data, medical expenses and individual activity. This information is given for pre-processing, so that it will clean all unwanted information and reduce redundant

information. After this, cleaned information is secured by using cryptography techniques and stores it on cloud, as shown in Figure 4.

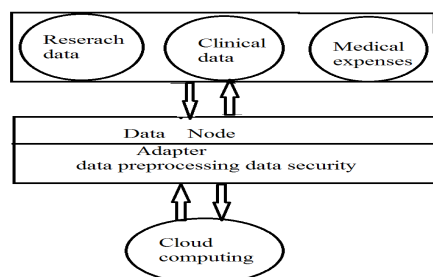


Figure 4: Information Collection Component

Data sources for information collection are research data, clinical data, medical expenses and individual activity [13]. Healthcare history of patients is huge information that has to maintain for research work and for doctors concerns and references. It includes various medical notes, prescriptions, medical reports. Medical information is very important for doctors to tract the disease of patient and to get rid of it, and to take care of patient. Medical expense information contains medical bill and medical insurance reimbursement, which has to analyze to get estimated cost. Research data contains medical trial data and screening data. Electronic health record is used to keep basic profile information on a patient. Clinical information contains doctor's observation about patient and his background medical data and back history. Lab data is documentation containing all reports and observation of patient. All these medical information and research data is then provided to adapter [9]. It has data pre-processor and encrypter. Data pre-processor will clean the input medical data and remove redundancy and repeated unused data. After these, it will do compression and pre-processing of that data, according to the modules of application. Encryption module encrypts these health care data to ensure security of that information during transmission from unauthorized user [10]. Thus, unauthorized user can't decrypt these data and misuse these.

Management Component

Management component has information storage on cloud and parallel computing unit, as shown in Figure 5. In this, big data analysis is used to handle large, heterogeneous information.

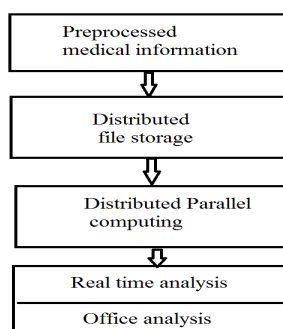


Figure 5: Health Care Information Management

Heterogeneous information contains all differently structured medical information. As they are differently structured and unstructured information, they are difficult to handle and managed by software. This information is stored in file system. The concept of client and server is uses here to store large, huge biomedical information. All information

related to patient, lab report, research work and other document is stored on server. Usually, other system called client access this information from server. One or more sites can use this information simultaneously, with the help of cloud computing. This information is divided into three component i.e. data description, data entity and data security. Distributed parallel computing component processes data taken from distributed file systems, and then perform analysis to achieve user requirement [2].

Application Program Interface Component

Application service interface framework provides development, management and operating platform, as shown in Figure 6.

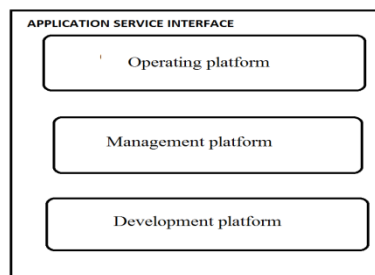


Figure 6: Application Program Interface Component

All uniform tools such as uniform application program interface and test-data are used to develop application [1]. All application development management, deployment and monitoring management is done by management platform. All software, hardware and databases are managed by operating system management.

CONCLUSIONS

Cyber-physical systems are innovated to combine actual physical hardware and components with computational component and software in biomedical field. It is a device, which is operated by computer programs and techniques, and it uses high performance internet service to collaborate with user requirement. This paper has presented a digital health care system using cloud and big data technology [3]. It has information collection component, where, all information related to health care is collected from various heterogeneous sources such as research data, clinical data, medical data coming from various firms and government sources, patient data etc. All these information is then pre-processed according to application demands, and then cloud and big data technology is used to analyse and manage all these health care information, which is further given to application service interface. It manages and develops a uniform application program interface for users. It can be concluded that, these computer technologies are proved to be more useful in health care applications and services.

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